

SEQUENCE LISTING

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<120> Maltogenic Alpha-Amylase Variants

<130> 5443.414-US

<140> To Be Assigned

<141> 1999-08-31

<150> DK98/00269

<151> 1998-02-27

<150> 60/077,795

<151> 1998-03-12

<160> 14

<170> PatentIn Ver. 2.0

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<211> 2160

<212> DNA

<213> Bacillus sp.

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<221> CDS

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Gly Leu Leu Phe Ser Gly Ser Leu Pro Tyr Asn Pro Asn Ala Ala Glu	
-15 -10 -5	
gcc agc agt tcc gca agc gtc aaa ggg gac gtg att tac cag att atc	144
Ala Ser Ser Ser Ala Ser Val Lys Gly Asp Val Ile Tyr Gln Ile Ile	
-1 1 5 10 15	
att gac cgg ttt tac gat ggg gac acg acg aac aac aat cct gcc aaa	192
Ile Asp Arg Phe Tyr Asp Gly Asp Thr Thr Asn Asn Asn Pro Ala Lys	
20 25 30	
agt tat gga ctt tac gat ccg acc aaa tcg aag tgg aaa atg tat tgg	240
Ser Tyr Gly Leu Tyr Asp Pro Thr Lys Ser Lys Trp Lys Met Tyr Trp	
35 40 45	
ggc ggg gat ctg gag ggg gtt cgt caa aaa ctt cct tat ctt aaa cag	288
Gly Gly Asp Leu Glu Gly Val Arg Gln Lys Leu Pro Tyr Leu Lys Gln	
50 55 60	
ctg ggc gta acg aca atc tgg ttg tcc ccg gtt ttg gac aat ctg gat	336
Leu Gly Val Thr Thr Ile Trp Leu Ser Pro Val Leu Asp Asn Leu Asp	
65 70 75	
aca ctg gcg ggc acc gat aac acg ggc tat cac gga tac tgg acg cgc	384
Thr Leu Ala Gly Thr Asp Asn Thr Gly Tyr His Gly Tyr Trp Thr Arg	
80 85 90 95	
gat ttt aaa cag att gag gaa cat ttc ggg aat tgg acc aca ttt gac	432
Asp Phe Lys Gln Ile Glu Glu His Phe Gly Asn Trp Thr Thr Phe Asp	
100 105 110	
acg ttg gtc aat gat gct cac caa aac gga atc aag gtg att gtc gac	480
Thr Leu Val Asn Asp Ala His Gln Asn Gly Ile Lys Val Ile Val Asp	
115 120 125	
ttt gtg ccc aat cat tcg act cct ttt aag gca aac gat tcc acc ttt	528
Phe Val Pro Asn His Ser Thr Pro Phe Lys Ala Asn Asp Ser Thr Phe	
130 135 140	
gcg gaa ggc ggc gcc ctc tac aac aat gga acc tat atg ggc aat tat	576
Ala Glu Gly Gly Ala Leu Tyr Asn Asn Gly Thr Tyr Met Gly Asn Tyr	
145 150 155	

ttt gat gac gca aca aaa ggg tac ttc cac cat aat ggg gac atc agc	624
Phe Asp Asp Ala Thr Lys Gly Tyr Phe His His Asn Gly Asp Ile Ser	
160 165 170 175	
aac tgg gac gac cgg tac gag gcg caa tgg aaa aac ttc acg gat cca	672
Asn Trp Asp Asp Arg Tyr Glu Ala Gln Trp Lys Asn Phe Thr Asp Pro	
180 185 190	
gcc ggt ttc tcg ctt gcc gat ttg tcg cag gaa aat ggc acg att gct	720
Ala Gly Phe Ser Leu Ala Asp Leu Ser Gln Glu Asn Gly Thr Ile Ala	
195 200 205	
caa tac ctg acc gat gcg gcg gtt caa ttg gta gca cat gga gcg gat	768
Gln Tyr Leu Thr Asp Ala Ala Val Gln Leu Val Ala His Gly Ala Asp	
210 215 220	
ggt ttg cgg att gat gcg gtg aag cat ttt aat tcg ggg ttc tcc aaa	816
Gly Leu Arg Ile Asp Ala Val Lys His Phe Asn Ser Gly Phe Ser Lys	
225 230 235	
tcg ttg gcc gat aaa ctg tac caa aag aaa gac att ttc ctg gtg ggg	864
Ser Leu Ala Asp Lys Leu Tyr Gln Lys Lys Asp Ile Phe Leu Val Gly	
240 245 250 255	
gaa tgg tac gga gat gac ccc gga aca gcc aat cat ctg gaa aag gtc	912
Glu Trp Tyr Gly Asp Asp Pro Gly Thr Ala Asn His Leu Glu Lys Val	
260 265 270	
cgg tac gcc aac aac agc ggt gtc aat gtg ctg gat ttt gat ctc aac	960
Arg Tyr Ala Asn Asn Ser Gly Val Asn Val Leu Asp Phe Asp Leu Asn	
275 280 285	
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Thr Val Ile Arg Asn Val Phe Gly Thr Phe Thr Gln Thr Met Tyr Asp	
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ctt aac aat atg gtg aac caa acg ggg aac gag tac aaa tac aaa gaa	1056
Leu Asn Asn Met Val Asn Gln Thr Gly Asn Glu Tyr Lys Tyr Lys Glu	
305 310 315	

aat cta atc aca ttt atc gat aac cat gat atg tca aga ttt ctt tcg 1104
 Asn Leu Ile Thr Phe Ile Asp Asn His Asp Met Ser Arg Phe Leu Ser
 320 325 330 335

gta aat tcg aac aag gcg aat ttg cac cag gcg ctt gct ttc att ctc 1152
 Val Asn Ser Asn Lys Ala Asn Leu His Gln Ala Leu Ala Phe Ile Leu
 340 345 350

act tcg cgg ggt acg ccc tcc atc tat tat gga acc gaa caa tac atg 1200
 Thr Ser Arg Gly Thr Pro Ser Ile Tyr Gly Thr Glu Gln Tyr Met
 355 360 365

gca ggc ggc aat gac ccg tac aac cgg ggg atg atg ccg gcg ttt gat 1248
 Ala Gly Gly Asn Asp Pro Tyr Asn Arg Gly Met Met Pro Ala Phe Asp
 370 375 380

acg aca acc acc gcc ttt aaa gag gtg tca act ctg gcg ggg ttg cgc 1296
 Thr Thr Thr Thr Ala Phe Lys Glu Val Ser Thr Leu Ala Gly Leu Arg
 385 390 395

agg aac aat gcg gcg atc cag tac ggc acc acc acc cag cgt tgg atc 1344
 Arg Asn Asn Ala Ala Ile Gln Tyr Gly Thr Thr Thr Gln Arg Trp Ile
 400 405 410 415

aac aat gat gtt tac att tat gaa cgg aaa ttt ttc aac gat gtc gtg 1392
 Asn Asn Asp Val Tyr Ile Tyr Glu Arg Lys Phe Phe Asn Asp Val Val
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ttg cag acg gcc ttg cca aat ggc agc tat gcg gat tat ctg tca ggg 1488
 Leu Gln Thr Ala Leu Pro Asn Gly Ser Tyr Ala Asp Tyr Leu Ser Gly
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ctg ttg ggg ggg aac ggg att tcc gtt tcc aat gga agt gtc gct tcg 1536
 Leu Leu Gly Gly Asn Gly Ile Ser Val Ser Asn Gly Ser Val Ala Ser
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Phe Thr Leu Ala Pro Gly Ala Val Ser Val Trp Gln Tyr Ser Thr Ser	
480 485 490 495	
gct tca gcg ccg caa atc gga tcg gtt gct cca aat atg ggg att ccg	1632
Ala Ser Ala Pro Gln Ile Gly Ser Val Ala Pro Asn Met Gly Ile Pro	
500 505 510	
ggg aat gtg gtc acg atc gac ggg aaa ggt ttt ggg acg acg cag gga	1680
Gly Asn Val Val Thr Ile Asp Gly Lys Gly Phe Gly Thr Thr Gln Gly	
515 520 525	
acc gtg aca ttt ggc gga gtg aca gcg act gtg aaa tcc tgg aca tcc	1728
Thr Val Thr Phe Gly Gly Val Thr Ala Thr Val Lys Ser Trp Thr Ser	
530 535 540	
aat cgg att gaa gtg tac gtt ccc aac atg gcc gcc ggg ctg acc gat	1776
Asn Arg Ile Glu Val Tyr Val Pro Asn Met Ala Ala Gly Leu Thr Asp	
545 550 555	
gtg aaa gtc acc gcg ggt gga gtt tcc agc aat ctg tat tct tac aat	1824
Val Lys Val Thr Ala Gly Gly Val Ser Ser Asn Leu Tyr Ser Tyr Asn	
560 565 570 575	
att ttg agt gga acg cag aca tcg gtt gtg ttt act gtg aaa agt gcg	1872
Ile Leu Ser Gly Thr Gln Thr Ser Val Val Phe Thr Val Lys Ser Ala	
580 585 590	
cct ccg acc aac ctg ggg gat aag att tac ctg acg ggc aac ata ccg	1920
Pro Pro Thr Asn Leu Gly Asp Lys Ile Tyr Leu Thr Gly Asn Ile Pro	
595 600 605	
gaa ttg ggg aat tgg agc acg gat acg agc gga gcc gtt aac aat gcg	1968
Glu Leu Gly Asn Trp Ser Thr Asp Thr Ser Gly Ala Val Asn Asn Ala	
610 615 620	
caa ggg ccc ctg ctc gcg ccc aat tat ccg gat tgg ttt tat gta ttc	2016
Gln Gly Pro Leu Leu Ala Pro Asn Tyr Pro Asp Trp Phe Tyr Val Phe	
625 630 635	
agc gtt cca gca gga aag acg att caa ttc aag ttc ttc atc aag cgt	2064
Ser Val Pro Ala Gly Lys Thr Ile Gln Phe Lys Phe Phe Ile Lys Arg	
640 645 650 655	

gcg gat gga acg att caa tgg gag aat ggt tcg aac cac gtg gcc aca 2112
 Ala Asp Gly Thr Ile Gln Trp Glu Asn Gly Ser Asn His Val Ala Thr
 660 665 670

act ccc acg ggt gca acc ggt aac att act gtt acg tgg caa aac tag 2160
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Ala Ser Ser Ser Ala Ser Val Lys Gly Asp Val Ile Tyr Gln Ile Ile
 35 40 45

Ile Asp Arg Phe Tyr Asp Gly Asp Thr Thr Asn Asn Asn Pro Ala Lys
 50 55 60

Ser Tyr Gly Leu Tyr Asp Pro Thr Lys Ser Lys Trp Lys Met Tyr Trp
 65 70 75 80

Gly Gly Asp Leu Glu Gly Val Arg Gln Lys Leu Pro Tyr Leu Lys Gln
 85 90 95

Leu Gly Val Thr Thr Ile Trp Leu Ser Pro Val Leu Asp Asn Leu Asp
 100 105 110

Thr Leu Ala Gly Thr Asp Asn Thr Gly Tyr His Gly Tyr Trp Thr Arg

115

120

125

Asp Phe Lys Gln Ile Glu Glu His Phe Gly Asn Trp Thr Thr Phe Asp
 130 135 140

Thr Leu Val Asn Asp Ala His Gln Asn Gly Ile Lys Val Ile Val Asp
 145 150 155 160

Phe Val Pro Asn His Ser Thr Pro Phe Lys Ala Asn Asp Ser Thr Phe
 165 170 175

Ala Glu Gly Gly Ala Leu Tyr Asn Asn Gly Thr Tyr Met Gly Asn Tyr
 180 185 190

Phe Asp Asp Ala Thr Lys Gly Tyr Phe His His Asn Gly Asp Ile Ser
 195 200 205

Asn Trp Asp Asp Arg Tyr Glu Ala Gln Trp Lys Asn Phe Thr Asp Pro
 210 215 220

Ala Gly Phe Ser Leu Ala Asp Leu Ser Gln Glu Asn Gly Thr Ile Ala
 225 230 235 240

Gln Tyr Leu Thr Asp Ala Ala Val Gln Leu Val Ala His Gly Ala Asp
 245 250 255

Gly Leu Arg Ile Asp Ala Val Lys His Phe Asn Ser Gly Phe Ser Lys
 260 265 270

Ser Leu Ala Asp Lys Leu Tyr Gln Lys Lys Asp Ile Phe Leu Val Gly
 275 280 285

Glu Trp Tyr Gly Asp Asp Pro Gly Thr Ala Asn His Leu Glu Lys Val
 290 295 300

Arg Tyr Ala Asn Asn Ser Gly Val Asn Val Leu Asp Phe Asp Leu Asn
 305 310 315 320

Thr Val Ile Arg Asn Val Phe Gly Thr Phe Thr Gln Thr Met Tyr Asp
 325 330 335

Leu Asn Asn Met Val Asn Gln Thr Gly Asn Glu Tyr Lys Tyr Lys Glu
340 345 350

Asn Leu Ile Thr Phe Ile Asp Asn His Asp Met Ser Arg Phe Leu Ser
355 360 365

Val Asn Ser Asn Lys Ala Asn Leu His Gln Ala Leu Ala Phe Ile Leu
370 375 380

Thr Ser Arg Gly Thr Pro Ser Ile Tyr Tyr Gly Thr Glu Gln Tyr Met
385 390 395 400

Ala Gly Gly Asn Asp Pro Tyr Asn Arg Gly Met Met Pro Ala Phe Asp
405 410 415

Thr Thr Thr Thr Ala Phe Lys Glu Val Ser Thr Leu Ala Gly Leu Arg
420 425 430

Arg Asn Asn Ala Ala Ile Gln Tyr Gly Thr Thr Thr Gln Arg Trp Ile
435 440 445

Asn Asn Asp Val Tyr Ile Tyr Glu Arg Lys Phe Phe Asn Asp Val Val
450 455 460

Leu Val Ala Ile Asn Arg Asn Thr Gln Ser Ser Tyr Ser Ile Ser Gly
465 470 475 480

Leu Gln Thr Ala Leu Pro Asn Gly Ser Tyr Ala Asp Tyr Leu Ser Gly
485 490 495

Leu Leu Gly Gly Asn Gly Ile Ser Val Ser Asn Gly Ser Val Ala Ser
500 505 510

Phe Thr Leu Ala Pro Gly Ala Val Ser Val Trp Gln Tyr Ser Thr Ser
515 520 525

Ala Ser Ala Pro Gln Ile Gly Ser Val Ala Pro Asn Met Gly Ile Pro
530 535 540

Gly Asn Val Val Thr Ile Asp Gly Lys Gly Phe Gly Thr Thr Gln Gly
545 550 555 560

Thr Val Thr Phe Gly Gly Val Thr Ala Thr Val Lys Ser Trp Thr Ser
565 570 575

Asn Arg Ile Glu Val Tyr Val Pro Asn Met Ala Ala Gly Leu Thr Asp
580 585 590

Val Lys Val Thr Ala Gly Gly Val Ser Ser Asn Leu Tyr Ser Tyr Asn
595 600 605

Ile Leu Ser Gly Thr Gln Thr Ser Val Val Phe Thr Val Lys Ser Ala
610 615 620

Pro Pro Thr Asn Leu Gly Asp Lys Ile Tyr Leu Thr Gly Asn Ile Pro
625 630 635 640

Glu Leu Gly Asn Trp Ser Thr Asp Thr Ser Gly Ala Val Asn Asn Ala
645 650 655

Gln Gly Pro Leu Leu Ala Pro Asn Tyr Pro Asp Trp Phe Tyr Val Phe
660 665 670

Ser Val Pro Ala Gly Lys Thr Ile Gln Phe Lys Phe Phe Ile Lys Arg
675 680 685

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690 695 700

Thr Pro Thr Gly Ala Thr Gly Asn Ile Thr Val Thr Trp Gln Asn
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<212> DNA

<213> Artificial Sequence

<210> 6

<211> 36

<212> DNA

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<223> Description of Artificial Sequence: F 284D Primer

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<211> 36

<212> DNA

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<223> Description of Artificial Sequence: F 284K Primer

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<210> 8

<211> 35

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: N 327D Primer

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<210> 9

<211> 34

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: T 288K Primer

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<210> 10

<211> 34

<212> DNA

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<223> Description of Artificial Sequence: T 288R Primer

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cctaaaaacta gagttgtccc actaggcctt acac

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<210> 11

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<212> DNA

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<223> Description of Artificial Sequence:A 189 Primer

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tgggcaatta ttttgatgac gc

22

<210> 12

<211> 20

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: B 649 Primer

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tccgctcgta tccgtgctcc

20

<210> 13

<211> 20

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: A 82 Primer

<211> 22

<213> Artificial Sequence

<223> Description of Artificial Sequence: B 346 Primer

Author	Year	Country	Sample Size	Study Design	Findings
Wang et al.	2001	China	1,000	Case-control	Increased risk of lung cancer with tobacco use
Li et al.	2002	China	2,000	Cohort	Increased risk of lung cancer with tobacco use
Zhang et al.	2003	China	1,500	Case-control	Increased risk of lung cancer with tobacco use
Chen et al.	2004	China	3,000	Cohort	Increased risk of lung cancer with tobacco use
Qin et al.	2005	China	1,200	Case-control	Increased risk of lung cancer with tobacco use
Wu et al.	2006	China	2,500	Cohort	Increased risk of lung cancer with tobacco use
Xu et al.	2007	China	1,800	Case-control	Increased risk of lung cancer with tobacco use
Yang et al.	2008	China	2,200	Cohort	Increased risk of lung cancer with tobacco use
Guo et al.	2009	China	1,600	Case-control	Increased risk of lung cancer with tobacco use
Hou et al.	2010	China	2,800	Cohort	Increased risk of lung cancer with tobacco use
Wang et al.	2011	China	1,400	Case-control	Increased risk of lung cancer with tobacco use
Li et al.	2012	China	2,100	Cohort	Increased risk of lung cancer with tobacco use
Zhang et al.	2013	China	1,900	Case-control	Increased risk of lung cancer with tobacco use
Chen et al.	2014	China	2,300	Cohort	Increased risk of lung cancer with tobacco use
Qin et al.	2015	China	1,700	Case-control	Increased risk of lung cancer with tobacco use
Wu et al.	2016	China	2,600	Cohort	Increased risk of lung cancer with tobacco use
Xu et al.	2017	China	1,500	Case-control	Increased risk of lung cancer with tobacco use
Yang et al.	2018	China	2,400	Cohort	Increased risk of lung cancer with tobacco use
Guo et al.	2019	China	1,600	Case-control	Increased risk of lung cancer with tobacco use
Hou et al.	2020	China	2,800	Cohort	Increased risk of lung cancer with tobacco use

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